

1 ABSTRACT

2 A method for fabricating a whispering-gallery-mode (WGM) optical resonator on an
3 optical fiber comprises the step of generating a differential of a physical property (diameter,
4 density, refractive index, chemical composition, and so forth) of a transverse resonator fiber
5 segment relative to the longitudinally adjacent fiber segments. The resonator fiber segment may
6 therefore substantially confine a WGM optical propagating around the resonator fiber segment
7 circumference at least partially within the resonator fiber segment. Specialized techniques for
8 spatially selectively generating the differential may include masking/etching, masking/deposition,
9 laser machining, laser patterning, combinations thereof, and/or functional equivalents thereof.
10 The WGM resonator may be further provided with an alignment flange and/or groove for enabling
11 passive positioning of the WGM resonator within an alignment groove of an alignment substrate.
12 A preferred method for fabricating an optical power control device according to the present
13 invention comprises the steps of: 1) fabricating a WGM resonator as described herein; 2) heating
14 and pulling a transmission optical fiber to form a fiber taper segment; 3) fabricating an alignment
15 substrate having a resonator-alignment groove and a fiber-alignment groove thereon; 4)
16 positioning and securing the fiber taper segment within the fiber-alignment groove; 5) positioning
17 and securing the WGM resonator within the resonator-alignment groove so that the WGM
18 resonator and the fiber taper segment are optically coupled (through close proximity and/or direct
19 contact between them). The alignment grooves are fabricated at the correct depths and positions
20 and with mating grooves and/or flanges to enable the optical coupling without extensive active
21 alignment procedures. A modulator may be provided as an integral component of the WGM
22 resonator, provided directly on the WGM resonator, or provided as a separate assembly
23 positioned on and secured with respect to the alignment substrate. The modulator enables control
24 of the optical properties of the WGM resonator, which in turn enables control of the optical
25 power transmitted through the fiber taper segment of the transmission optical fiber.